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EVOLUTION AND EDUCATION RESOURCES

The *Origin* Manuscripts at the "The Darwin Manuscripts Project"

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Abstract I announce the launch of the Darwin Manuscripts Project (http://darwin.amnh.org) and describe its importance as a source of professional-grade manuscripts by Charles Darwin. Some of its importance is due to the transcription of manuscripts, which records all information about the changes Darwin made as he wrote. A guide to understanding how to read a manuscript transcription is presented. This is intended to be the first in a series of papers which, together, will constitute a user's guide to the site.

Keywords Manuscripts · Charles Darwin · Origin of Species · Digital publishing · Archives

Darwin began writing *The Origin of Species* after he had learned of Alfred Russel Wallace's ideas about natural selection, most probably in June 1858 (Darwin 1991). Darwin and Wallace, with the help of Charles Lyell and J. D. Hooker, presented a jointly-authored paper (Darwin and Wallace 1858) to the Linnean Society in July 1858 (Darwin 1991). The joint paper assured that Darwin's name would be associated with the first public presentation of the principle of natural selection and the view that it is central to explaining taxonomic diversification. In October 1859, Darwin remarked (Darwin 1991) that he had "finished the last of the proof-sheets '13 months & 10 days' after he had begun to write the abstract [that is, *The Origin*]," which appeared in print by the end of November. This established Darwin as the leading thinker on natural selection and evolution as well as one of its co-discoverers.

Nonetheless, Darwin would have had indisputable claim to both even if he had not co-authored the 1858 Linnean Society paper or published the *Origin* so soon after. A substantial amount of manuscript material exists from the period of Darwin's voyage on the *H.M.S. Beagle* up to the completion of the *Origin* which clearly documents the development of his ideas. Among these manuscripts is a much longer volume, *Natural Selection*, in which he had intended to make the case for evolution and natural selection, including complete documentation of cases that he adduced as evidence. The *Origin* is an "abstract" of that larger work in the sense that it describes the mechanism of natural selection and demonstrates its explanatory power, but does not document instances of its occurrence at length. This is in addition to two shorter works, collected by Darwin's son Francis and published with the title *The Foundations of the* Origin of Species*: Two Essays Written in 1842 and 1844* (Darwin 1909). These were expanded and revised over the years, and Francis' title is a good one. Many of the ideas in the *Origin* can be traced back to one or the other of the essays.

Consideration of this period in Darwin's work and the periods immediately before it hold the promise of generating insights of particular importance about the nature and significance of evolutionary biology. Though his grandfather Erasmus had ideas about evolution, Darwin did not begin his study of natural history believing that evolution was real. While his family might be characterized as unconventional, they were not extremely so. Darwin came to natural history much

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as others in nineteenth century England did, and he was also equipped with other beliefs typical of those in the period, for instance, beliefs about religion and about the role of a supreme deity as a cause and explanation of biological diversity. Darwin changed his mind about many of these beliefs, and by the time the *Origin* was published in 1859, he was confident enough to affirm in its closing passage that natural selection is a law-like process akin to gravity.

> There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

Darwin's manuscripts are the historical record of how an apparently ordinary man came to believe the astonishing truth that there is strong evidence for a theory from which it follows that what we see as most important about ourselves—consciousness, language, art, and even our religious beliefs—are a part of our organic history. What facts did he collect, and how did he understand them? What conceptual innovations were required? What arguments did he consider? How did he transform strongly-held but unexamined beliefs into new and different ones? What did he think was most important and most interesting about what he had discovered? Following Darwin along the path he took to the theory of evolution by natural selection promises to inform the reader of today about how to travel that path on his or her own.

The Darwin Manuscripts Project (http://darwin.amnh.org) is an excellent resource for someone interested in the evidence for Darwin's claim of priority or in nature and extent of his thoughts on natural selection during the period prior to 1859. Redesigned and relaunched[1] for the "Darwin Year" of 2009, in which Darwin's 200th birthday and the 150th anniversary of the first publication of the *Origin* were celebrated, the Project aims to create and distribute, free of charge, professional-grade copies of Darwin's manuscripts from all periods of his work. Some manuscripts have already been prepared and are being uploaded at present. Important among these is a collection entitled "The *Natural Selection* Portfolios," which contains manuscripts reflecting Darwin's thinking in the period leading up to the 1859 publication of the first edition. Other such collections of manuscripts are in various stages of preparation but nearly complete, and will be added to the site in the upcoming months; work on others is nearer to the start of the editing and digitization process.

The aim of this brief paper is to outline the central aims and methods of the Darwin Manuscripts Project, and to detail a collection of manuscripts available online at present: the remaining known leaves of Darwin's manuscript of the first edition of the *Origin*. This paper should be considered to be the first installment of a set of papers meant to form a user's guide and companion to the site, to be published here as more manuscripts are added and as the services for organizing, searching, and viewing them become fully functional. Readers are advised that I am associate editor of the site; but since my aim is to accurately describe its best uses—and this includes its limitations—there is little scope for bias.

Overview of the Darwin Manuscripts Project

The Darwin Manuscripts Project is a publishing venue designed to take advantage of the particular strengths of digital publishing on the Internet. Notable among these strengths is that the Internet reaches a broad audience, including, potentially, anyone in the world who has access to the World Wide Web. This increases access to Darwin's manuscripts by a factor of millions if not tens or hundreds of millions. A small proportion of Darwin's manuscripts has been published in print; those as well as all the others exist in single copies in library and museum collections. Viewing them requires travel to these libraries or museums, a journey impossible for most people and made only by relatively few to date. Whatever the number, it is diminishingly small compared to those who have access to the World Wide Web.

The Project also takes advantage of the flexibility of the digital format. Individual items are presented in different views, each bringing out different important elements of the item. Items may be grouped together by project editors, or by site users, in effect creating custom manuscript collections. Using the search tool, the user can rapidly access manuscript content. This flexibility, possible even with the simplest interfaces to digital materials, is unparalleled by any similar capacity of print media. As in the case of breadth of distribution, the flexibility of digital publishing brings particularly significant benefits to the publication of manuscripts. In both cases, presenting manuscripts in a way that does not require handling them is also particularly impor-

[1] Until recently, the Project home was at http://darwinlibrary.amnh.org.

tant. Because they exist in single copies, and because they consist of materials not chosen specifically for durability and longevity, removing a manuscript from storage, or indeed moving it at all, requires taking on the risk that the information it bears may be lost forever.

The ability to create collections or "manuscript units" in a manner unconstrained by the physical limitations of print allows for the creation of alternative *scholarly editions* of Darwin manuscripts. The central principles of archives design require organizing the archived material by the relationships which obtain among them that developed as they were created. For instance, a slip of paper found in a book should be kept with the book, and its location noted. Researchers might come to discover that the writing on the slip of paper is a reaction to what was written on the pages between which it was found. In contrast, a scholarly edition is a collection of manuscripts organized by their relationships to one another as seen by a researcher. In Darwin's case, this might include, for instance, manuscripts all bearing on a given subject such as human evolution or the origin of species. These manuscripts are found in different places in the Darwin archive, and the scholar organizing them would not necessarily organize the documents on the topic of interest in the same manner Darwin would have—indeed, there are topics of interest to researchers today which Darwin had no understanding of whatever, for instance, chromosomal inheritance, or different theories of the origin of species.

The Remaining Sheets of the *Origin* Drafts

The archival material published online for the November 2009 relaunch of the Darwin Manuscripts Project site is particularly apt for the *Origin* anniversary: the known surviving pages[2] of Darwin's near-final draft of that work. Internet users can access the collection from the Project homepage, http://darwin.amnh.org. This is an archival collection in the sense discussed above: materials are arranged to preserve the natural relationships among them at the time of their creation and subsequent use. In the case of these manuscript pages, this is not as difficult as in other cases: the pages are numbered sequentially, and it is possible to identify the passages from each manuscript page that appeared in print. As will be explained in greater detail below, these manuscripts are now held in collections around the world; it is not possible to gather the manuscripts themselves all in one place at once. Digital publication is the mechanism by which the archive of *Origin* draft pages can be created, if not in physical form.

Randal Keynes and David Kohn call attention to some of more intriguing aspects of the archive (Keynes and Kohn 2009).[3] Of 42 leaves known to exist, 36 are collected in the archive. The remaining six are "known to exist from auction sales [but] have yet to be located." Keynes and Kohn estimate that "the full manuscript could have contained as many as 550–580 numbered sheets and the surviving [sheets] are indeed rare, amounting to some 7% of the total." The pages at the Darwin Manuscripts Project come from various sources, including London's Natural History Museum, the Cambridge University Library, the collection at Down House, a museum at Darwin's home; Lehigh University; Harvard University; the American Philosophical Society, and The American Museum of Natural History, among other places. The archive was assembled with the help of Mr. Milton Forsyth, "who has been carrying out a similar search for leaves of the *Origin* for some time." The rarity and importance of these manuscript pages has made them of special interest to collectors, "one being sold at Sotheby's in New York for $275,000."

The Darwin Manuscript Project manuscripts occupy a "place between the manuscript of *Natural Selection* and the published text of the *Origin of Species*." "In 1856, at Lyell's instigation, [Darwin] started writing a slightly expanded version of the 1844 essay."[4] This expanded version of the essays "grew into a larger text which he [Darwin] planned to publish with the title *Natural Selection*." The manuscripts on the site show revisions made by Darwin to proofs of the sections of his *Natural Selection* manuscript which he intended to publish in the *Origin*. The initial eight chapters of the *Origin* and the ninth are revisions of *Natural Selection* manuscripts; the remaining *Origin* chapters were created anew. After he completed the revisions seen in the Project manuscripts, he made further revisions to the *Origin*, "[devoting] his main effort to clarifying the text for the general reader." The writing was difficult

[2] Visitors to the site will see that the archive is entitled "A Gathering of the Rare Surviving *leaves* of the *Origin* Manuscript." Bibliographers use "leaves" to refer to the sheets of paper which make up a book. "Page" refers to one side of a leaf. Consider that it is natural to say about a book that it has 100 pages—there are 50 leaves, each side of which is a page. "Page" will be used in what follows to refer to leaves as well as faces of leaves. This is more familiar to most readers and is unlikely to cause confusion.

[3] All quotations and facts reported in the remainder of this section are drawn from the Keynes and Kohn introduction.

[4] This essay is referred to above as being a part of the contents of *The Foundations of* The Origin of Species (Darwin 1909).

for Darwin, "leading to a physical breakdown in May 1859."

The fate of the manuscript after Darwin completed it offers evidence for the statement that truth is stranger than fiction: A comedy of errors representing as fantasy what really happened to the *Origin* manuscripts would be so far-fetched that it would be impossible to suspend disbelief. One series of events in the manuscript's history is remarkable for its charm. "Darwin often used the backs of his old manuscripts for rough notes" and

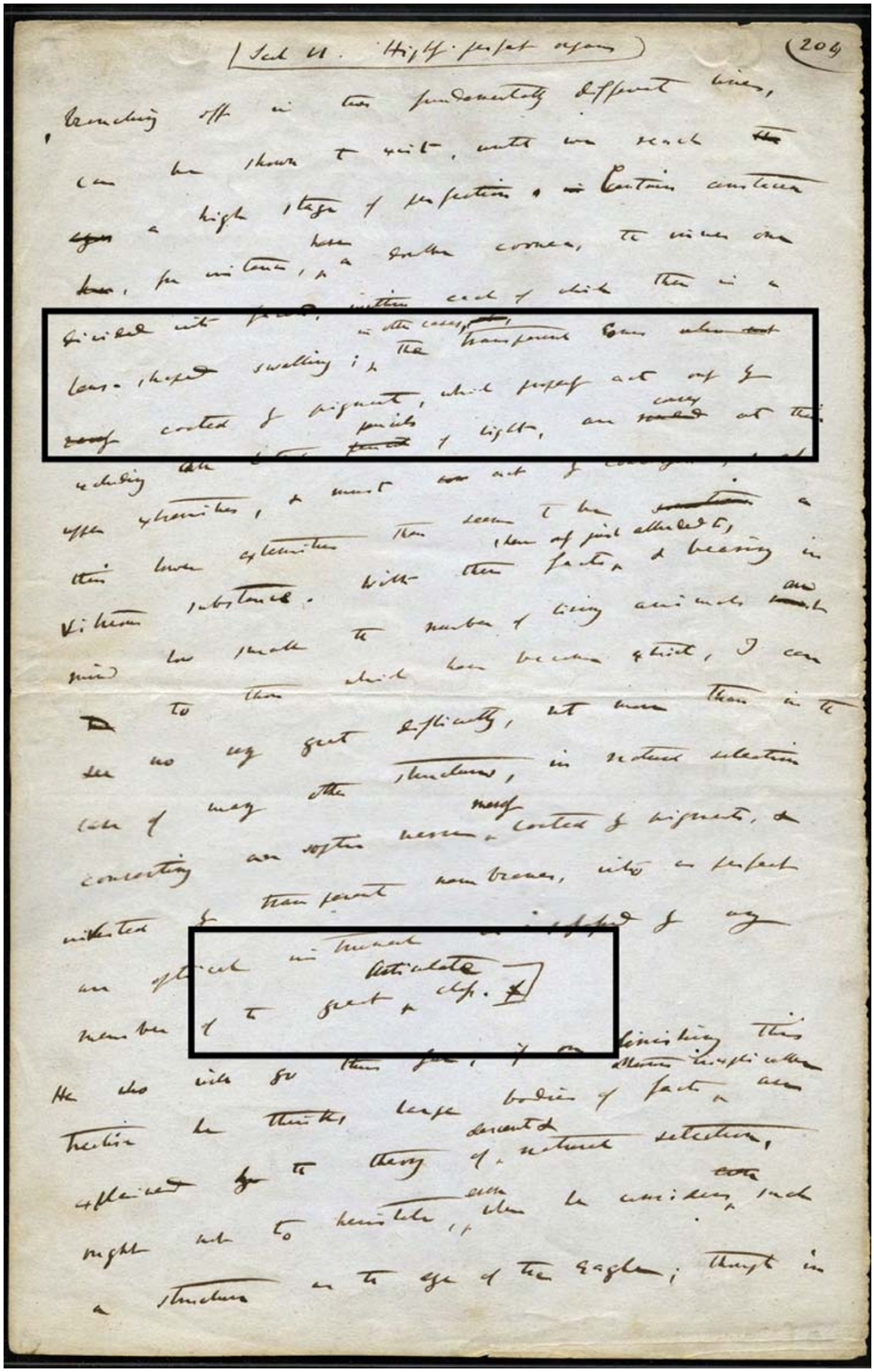


Fig. 1 Image of *Origin* manuscript page 204, call number RF-18-H, Research Library, American Museum of Natural History. Image WWW address: http://darwin.amnh.org/image_viewer.php?eid=72891. Rectangles indicate the location of the excerpts shown below. The larger rectangle at the top is shown in detail in Fig. 2; the smaller rectangle at the bottom is shown detail in Fig. 3. See text for details

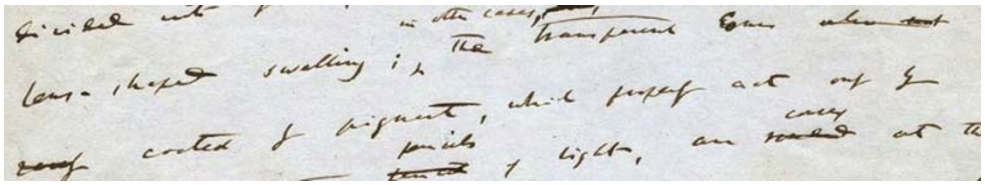


Fig. 2 Excerpt from image of *Origin* manuscript page 204, call number RF-18-H, Research Library, American Museum of Natural History. This excerpt shows the area in the larger rectangle, at the top of the image in Fig. 1. Image WWW address is the same as in Fig. 1. See text for details

"allowed his children to use one side for their notes and drawings." Presumably, some of the *Origin* manuscript pages met the same fate as "a sheet from the fair copy of Chapter I of the *Origin*," which was in a "pile of papers kept in a cupboard under the stairs." This particular sheet was "recovered from this pile … with a drawing by Darwin's son Francis aged ten at the time." Other sheets were dispersed well beyond the cupboard under the stairs. Henrietta Darwin, Charles' daughter, presented leaves of the *Origin* manuscript to "a number of acquaintances," including Henry Fairfield Osborne of the American Museum of Natural History. This is the provenance of the single *Origin* manuscript leaf in the AMNH collection. The bulk of the remaining manuscript pages were distributed among Darwin's heirs for them to dispose of as they saw fit.

A Closer Look at a Manuscript Page

The achievement of the Darwin Manuscripts Project is that it presents the manuscripts in a manner which transmits all information borne by each sheet, and indeed, augments it. There are several barriers to publishing manuscripts in a way that does not destroy their content. First, Darwin's handwriting is difficult to read. In addition to an image of each manuscript, the Project site publishes a transcription, created by a scholar trained in reading Darwin's handwriting. If the transcription were to simply record the final text of the manuscript, information would be lost: Transcribing what Darwin regarded as the fully corrected version of a manuscript page would not show the process by which he arrived at it. This can be seen by looking at almost any of the *Origin* manuscript pages, on which Darwin's deletions and insertions are clearly visible in his own hand. In the case of notes or drafts to which Darwin returned many years after their initial creation, this information is critical, because it shows how Darwin affirmed, modified, differed, or added to his earlier reflections. In such cases, identifying the writing implement can help date when both original and later text were written; paper stock can provide similar information, which must be included in annotations to any good transcription. These aspects of a manuscript cannot typically be detected in scanned images, photographs, or microfilm reproductions. In the case of the *Origin* manuscripts, these concerns are less critical, because the time period of their composition is known, and revisions reflect Darwin's struggle with a continuous process of composition rather than a reconsideration of earlier ideas after a long interval. In the case of the Natural Selection Portfolios mentioned above, in contrast, all information about the manuscript

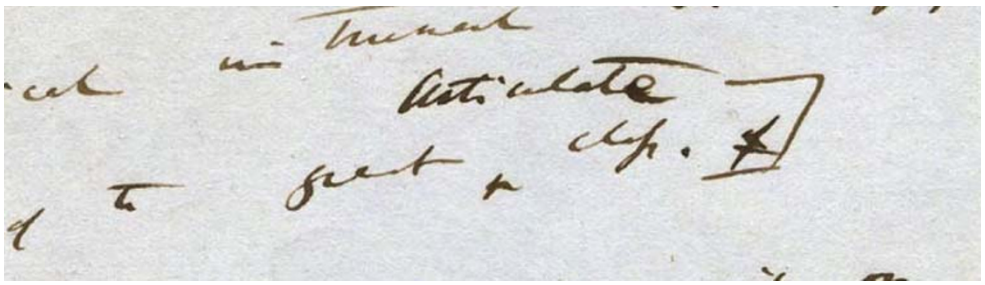
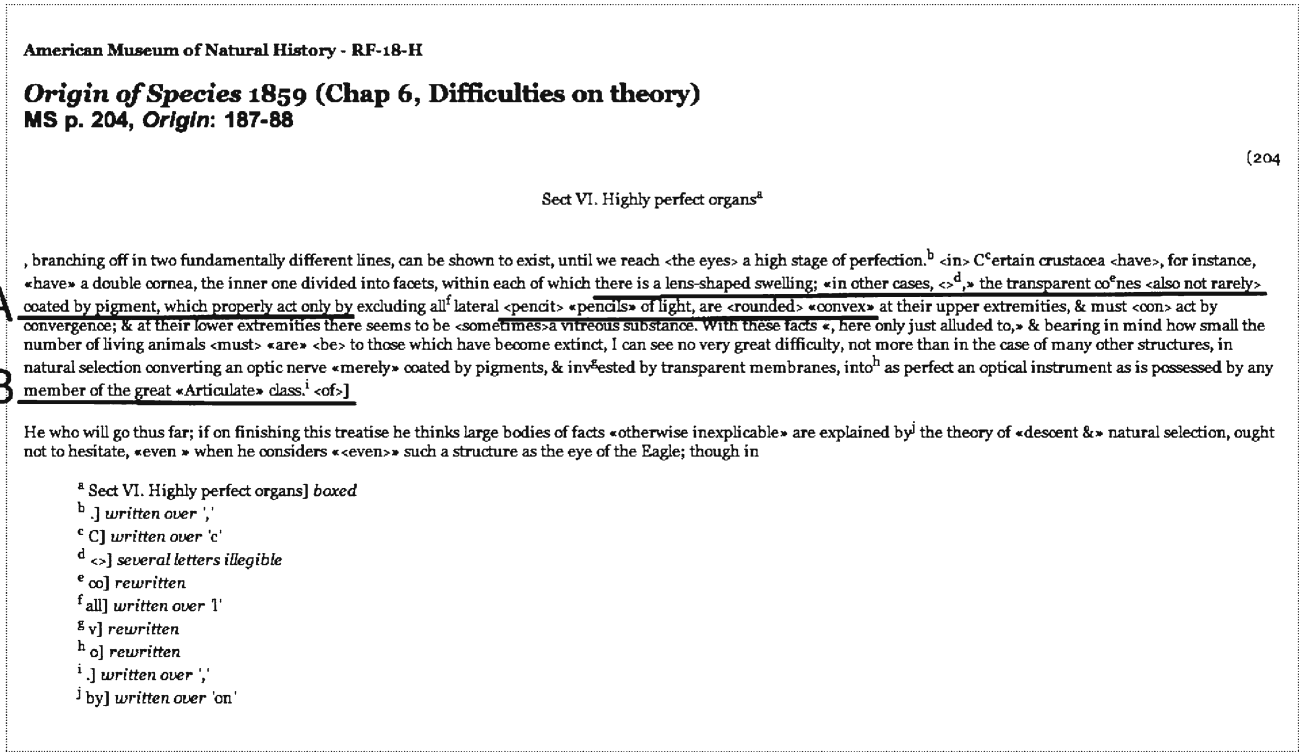


Fig. 3 Excerpt from image of *Origin* manuscript page 204, call number RF-18-H, Research Library, American Museum of Natural History. This excerpt shows the area in the smaller rectangle, at the bottom of the image in Fig. 1. Image WWW address is the same as in Fig. 1. See text for details



American Museum of Natural History - RF-18-H

***Origin of Species* 1859 (Chap 6, Difficulties on theory)**
MS p. 204, *Origin*: 187-88

(204

Sect VI. Highly perfect organs[a]

, branching off in two fundamentally different lines, can be shown to exist, until we reach <the eyes> a high stage of perfection.[b] <in> C[c]ertain crustacea <have>, for instance, «have» a double cornea, the inner one divided into facets, within each of which there is a lens-shaped swelling; «in other cases, <>[d],» the transparent co[e]nes <also not rarely> coated by pigment, which properly act only by excluding all[f] lateral <pencit> «pencils» of light, are <rounded> «convex» at their upper extremities, & must <con> act by convergence; & at their lower extremities there seems to be <sometimes>a vitreous substance. With these facts «, here only just alluded to,» & bearing in mind how small the number of living animals <must> «are» <be> to those which have become extinct, I can see no very great difficulty, not more than in the case of many other structures, in natural selection converting an optic nerve «merely» coated by pigments, & inv[g]ested by transparent membranes, into[h] as perfect an optical instrument as is possessed by any member of the great «Articulate» class.[i] <of>]

A

B

He who will go thus far; if on finishing this treatise he thinks large bodies of facts «otherwise inexplicable» are explained by[j] the theory of «descent &» natural selection, ought not to hesitate, «even » when he considers «<even>» such a structure as the eye of the Eagle; though in

[a] Sect VI. Highly perfect organs] *boxed*
[b] .] *written over* ','
[c] C] *written over* 'c'
[d] <>] *several letters illegible*
[e] co] *rewritten*
[f] all] *written over* 'l'
[g] v] *rewritten*
[h] o] *rewritten*
[i] .] *written over* ','
[j] by] *written over* 'on'

Fig. 4 Transcription of *Origin* manuscript page 204, call number RF-18-H, Research Library, American Museum of Natural History. Underlined passages adjacent to "A" are transcriptions of the area of detail shown in Fig. 2; underlined passages adjacent to "B" are transcriptions of the area of detail shown in Fig. 3. Transcription WWW address: http://darwin.amnh.org/viewer.php?eid=72891. See text for details

must be brought into play to correctly identify the most important aspects of the archive.

An example illustrates how annotations can provide all (if not more) information carried by a scanned manuscript. Consider the single *Origin* manuscript page in the collection of the American Museum of Natural History, which, as mentioned above, was a gift of Henrietta Darwin to Henry Fairfield Osborne. Figure 1 shows the entire manuscript page, which site visitors can see on their screens. Moving the mouse pointer over the image will magnify the writing to near full-size without any loss of clarity. The two rectangles on Fig. 1 show areas of detail which are shown in Figs. 2 and 3, while Fig. 4 shows the transcription as it appears on the site. The underlined passages marked with "A" on the transcription indicate the transcription of text in Fig. 2; "B" marks the transcription of text in Fig. 3.

Table 1 Annotations to Darwin's manuscripts

Annotation	Deletion	Interline
Symbol	<mockingbird>	«orchid»
Explanation	Darwin crossed out "mockingbird".	Darwin wrote "orchid" between lines.

These images show how the transcription preserves all the information in the manuscript. (See Table 1 for an explanation of the annotations.) The transcription of the manuscript at "A" shows the following.

- The phrase was first put down as "… there is a lens shaped swelling; the transparent cones also not rarely coated by pigment …."
- Darwin reconsidered, deleting, with a pen-stroke, "also not rarely," and replacing, by writing above the line ("interlining") "in other cases." Footnote "d" indicates that Darwin wrote and crossed out characters, rendering them illegible. Perhaps this is due to hesitation about some important scientific point; or perhaps about stylistic matters; or perhaps he simply became distracted by his surroundings or his physical condition.
- The resulting phrase reads "… there is a lens shaped swelling; in other cases, the transparent cones coated by pigment …." This represents a slight but definite change in sense: "not rarely" implies (the phrase deleted by Darwin) that the transparent cones are frequently or usually coated with pigment, while "in other cases" does not. If

> only the second, final rendering were transcribed, readers would not be aware that Darwin changed his mind about this. This is generally true of all such changes, some of which are of considerable importance for understanding the historical record of Darwin's thought.

Consulting the 1859 *Origin* (Darwin 1859, 187), it appears that Darwin made further changes, rendering the passage as follows. Emphasis shows the phrase under consideration.

> In certain crustaceans, for instance, there is a double cornea, the inner one divided into facets, within each of which *there is a lens shaped swelling. In other crustaceans the transparent cones which are coated by pigment*, and which properly act only by excluding lateral pencils of light, are convex at their upper ends and must act by convergence; and at their lower ends there seems to be an imperfect vitreous substance.

The passage marked "B" seems to have been written and rewritten as follows. Darwin began writing

> of the great,

but then hesitated, crossing out the comma, and continued with

> of the great class of

but then revised this, interlining "Articulate," crossing out "of," and ending the sentence, resulting in

> of the great Articulate class.

From then on, the passage remains unchanged, appearing in the 1859 *Origin* (Darwin 1859, 188).

> … I can see no very great difficulty (not more than in the case of many other structures) in believing that natural selection has converted the simple apparatus of an optic nerve merely coated with pigment and invested by transparent membrane, into an optical instrument as perfect as is possessed by any member of the great Articulate class.

Concluding Remarks

Understanding the changes and developments in Darwin's thinking in the period leading up the *Origin of Species* can offer historical insight into the origins of evolutionary biology and offer an opportunity to reflect on its significance. The Darwin Manuscripts Project, relaunched and redesigned for the 150th Anniversary of the *Origin*, is a digital publishing endeavor aimed at distributing scholarly editions of Darwin's manuscripts to a worldwide audience. By annotating manuscript transcriptions, the Project can publish digital copies of Darwin's manuscripts without loss of information; and because the transcriptions are created by experts in reading Darwin's handwriting, they provide more information for non-experts than the manuscript itself. The aim of this paper is to help Internet users understand what they are looking at when they are reading the collection available online at the time of this writing: the rare and important manuscripts of the *Origin of Species*. Future papers will aim at describing manuscript collections as they are added, and will offer more insight into the innovations in digital infrastructure and design embodied by the Project.

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